Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER – III • EXAMINATION – WINTER 2012

Subject code: X 30903 **Date: 31/12/2012**

Subject Name: Control Theory

Time: 10.30 am - 01.00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Compare closed loop versus open loop control system.	**07**
	(b)	Establish relationship between transfer function and state space equation.	**07**
Q.2	**(a)**	Simplify the block diagram shown in figure-1.	**07**
	(b)	For the mechanical system shown in figure-2, write state space equations.	**07**
		OR	
	(b)	For the electrical system shown in figure-3, write state space equations.	**07**
Q.3	**(a)**	Find transfer function using Mason's gain formula for the system shown in figure-1.	**07**
	(b)	Explain thermal systems in brief. Also define thermal resistance and thermal capacitance.	**07**
		OR	
Q.3	**(a)**	Explain liquid systems in brief. Also define resistance and capacitance of liquid level system.	**07**
	(b)	Discuss step response of second order system for underdamped, critically damped and overdamped cases.	**07**
Q.4	**(a)**	Discuss various transient response specifications.	**07**
	(b)	For the system shown in figure-4, ξ=0.6, ω_n=5 rad/sec. Find rise time t_r, peak time t_p, Maximum overshoot M_p and settling time t_s when the unit step input is applied to the system.	**07**
		OR	
Q.4	**(a)**	Mention procedure of Routh's stability criterion. Discuss special cases with suitable example.	**07**
Q.4	**(b)**	Consider the closed loop system shown in figure-5. Determine the range of K for stability. Assume K>0.	**07**
Q.5	**(a)**	Draw the root locus for the system shown in figure-6.	**07**
	(b)	Discuss Nyquist stability criterion. Comment on stability analysis.	**07**
		OR	
Q.5	**(a)**	Find gain and phase margin for the system shown in figure-7 using bode plot technique. Here K=10.	**07**
	(b)	Explain root loci for system with transport lag.	**07**

P.T.O.

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FIGURES

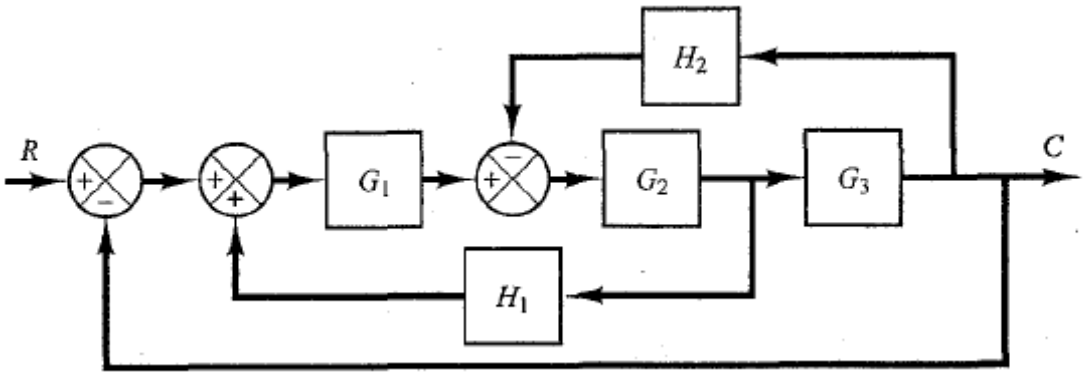

Fig. 1

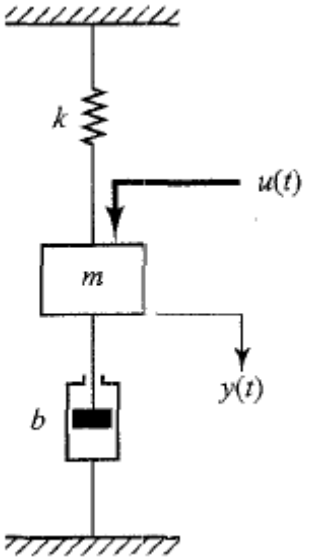

Fig. 2

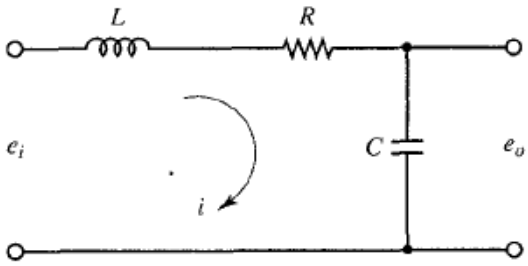

Fig. 3

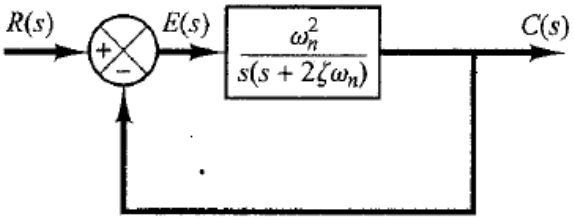

Fig. 4

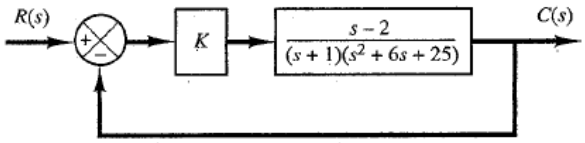

Fig. 5

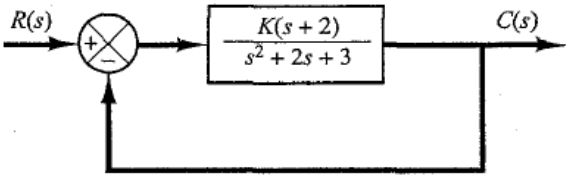

Fig. 6

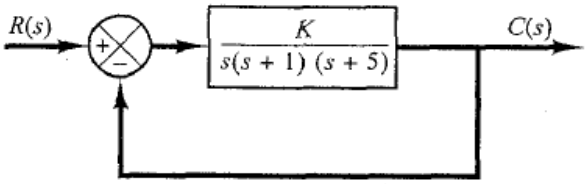

Fig. 7